MATERIALS BUREAU

TECHNICAL REPORT 89-2

EVALUATION OF THE FLUOROCARBON "UNI-TON" BRIDGE BEARING

FINAL REPORT

JUNE, 1989

M.A.P. CODE 7.42-6-89-2

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
MARIO M. CUOMO, Governor
FRANKLIN E. WHITE, Commissioner

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EVALUATION OF THE FLUOROCARBON "UNI-TON" BRIDGE BEARING
FINAL REPORT

Conducted in Conjunction with
The U.S. Department of Transportation
Federal Highway Administration
Experimental Feature Project Number NY 81-04

Prepared by

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June, 1989

MATERIALS BUREAU
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ABSTRACT

Historically, curved structures have presented unique problems for designers and project engineers. Perhaps one of the more difficult is the correct alignment of the bridge and its bearing systems. After expansion and contraction are calculated, it still remains a problem to align the direction of this movement to the structure. This report examines a center-guided expansion bearing system that requires only approximate alignment during installation as self-alignment occurs on the first expansion or contraction of the structure. As a result of six years of satisfactory performance, the Department will adopt the center-guided expansion bearing concept as an alternative to conventional pot bearings.

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I. INTRODUCTION

The purpose of this study is to evaluate the installation, performance, and economics of the proprietary Fluorocarbon, "Uni-Ton" self-aligning, laterally restrained bridge bearing.

The Uni-Ton bridge bearing was manufactured by Fluorocarbon, Inc., Pine Brook, New Jersey. The bearing accommodates structural bearing (vertical) load and rotation through the use of a confined elastomer. Longitudinal movement is taken by the sliding of polished stainless steel on polytetrafluoroethylene (PTFE) sheet. Lateral restraint and self-alignment are provided by a "keyway" at the sliding surface. Appendix B contains the manufacturer's schematic drawing and technical data for the bearing.

Unlike conventional "pot" type guided expansion bearings, precision alignment is not required with the Uni-Ton bearing. The keyway-restraint system is designed to orient itself in the direction of stringer movement with the first expansion or contraction of the structure. This self-aligning feature is particularly advantageous on curved structures where girder movement is difficult to predict accurately.

II. TEST SITE

The Uni-Ton bearings were installed on Bridge No. 5, Ramp SM of the Cross-Westchester Expressway over the Saw Mill River Parkway. This work was performed in conjunction with: Contract No. D250066, PIN 8106.14, FA Proj. No. F-261-(105), Sprain Brook Parkway (C.W.E. to Bradhurst Avenue) OC 77-40. The project also included the repair of low steel sliding bearings on five (5) additional structures.

Bridge No. 5 is a two-span continuous curved structure (23° curve-250' radius). A total of six (6) Uni-Ton bearings (3 at each abutment) were installed.

III. BACKGROUND

The six structures on this project were originally constructed in 1979 under Contract D95707. All bearings installed in the initial construction were low steel sliding type bearings. These bearings were designed with mating, machine finished, steel-bronze alloy sliding plates to provide for longitudinal movement. With this type bearing the bronze plate must be greased to reduce friction between the sliding surfaces.

The low-steel bearings installed under Contract D95707 incorporated slotted holes in the masonry plate. These holes were then covered by a rectangular, fully-welded washer and bolted to the anchor bolts. Due to a misinterpretation of the specifications, the bronze-alloy plates were not greased. Shortly after installation, friction between the ungreased sliding plates developed that was sufficient to cause movement of the masonry plates. This movement applied a force on the anchor bolts which caused them to shear.

NOTE: The Department's present policy is to fill the slotted holes in the masonry plate with mortar. Washers on anchor bolts are no longer welded in place.

The anchor bolt failure occurred on all six structures and resulted in the bearings (and bridge) not being secured to the substructure. Additionally, on Bridge No. 5 the low steel bearings proved to be ineffective in restraining lateral (horizontal) movement in that the bridge had moved approximately 3 inches. This lateral movement was believed due to bearing misalignment.

To correct these problems, Contract D250066 was let. Work on this contract consisted of the replacement of anchor bolts, repairs to the low steel bearings on five (5) of the structures, and the replacement of the low steel bearings with the Uni-Ton bearings on Bridge No. 5. The self-aligning type bearings were specified on Bridge 5 because this structure presented the most severe design conditions. The bridge is curved (23° - 250' radius), superelevated, and on a 5.52% grade, a configuration that would make girder movements difficult to predict.

IV. INSTALLATION OF UNI-TON BRIDGE BEARING

Before installing the Uni-Ton bearings on Bridge No. 5, an attempt was made to jack the structure laterally to its original position. The desired movement could not be obtained using the prescribed jacking loads, and a decision was made to leave it "as is."

A total of six (6) Uni-Ton bearings (3 at each abutment) of different load capacities were installed. The inside radius girder is supported by 100 kip bearings, the center girder by 125 kip bearings and the girder on the outside radius by 200 kip bearings. (Figure 1).

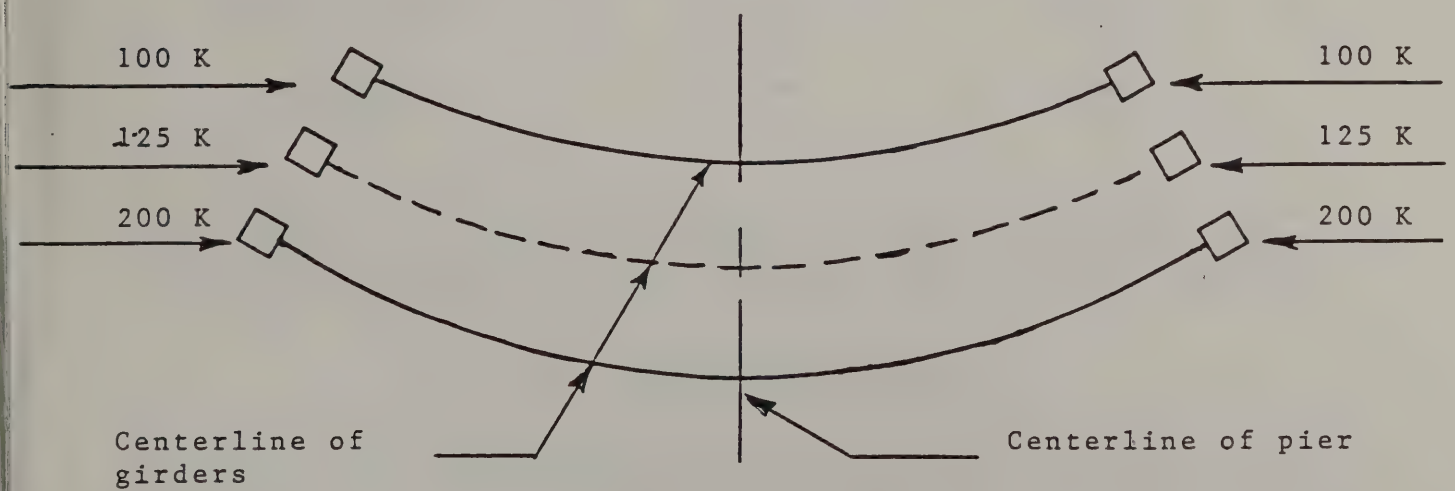


FIGURE 1
UNI-TON BEARING INSTALLATION (Not to Scale)

The installation proceeded smoothly with only minor problems. The bridge was jacked slightly, and the low steel bearings removed. The existing anchor bolts were removed and their holes grouted over. New holes were drilled in the concrete pedestal and new bolts installed in the location necessary to accommodate the horizontal movement that had occurred. The Uni-Ton bearings were then bolted into place and the slotted holes filled with grout. Although not required with the Uni-Ton bearing, alignment was recalculated and the top (upper) load plate was carefully positioned before being welded to the girder.

During the drilling operation for the installation of new anchor bolts on the west abutment 200 kip bearing pedestal, several cracks developed from the new holes to the edge of the concrete. This problem was avoided on the remaining five pedestals by drilling at a slower speed and maintaining perpendicularity of the hand held drill. Another problem that developed was damage to one of the Uni-Ton bearing's sliding surfaces before installation. The bearing had been disassembled and left uncovered on the bridge abutment and was inadvertently showered with weld spatter during a cutting operation. The mirror finished stainless steel sliding plate had to be returned to the factory for replacement, causing a short delay in the completion of the project.

V. COST ANALYSIS

Table 1 compares the cost of the Uni-Ton laterally restricted bearings with the cost of another manufacturer's guided expansion type pot bearings. The prices are for the bearings only, delivered to Albany, NY, and do not include installation charges.

TABLE 1
COST COMPARISON: UNI-TON AND POT BEARING (1983)

Bearing Capacity	Uni-Ton	Pot Bearing
100 kip	$479	$300
125 kip	$566	$375
200 kip	$825	$600

On this project, the contractor bid $1200 for each Uni-Ton bearing regardless of capacity. The price also included installation. Structural lifting operations were an additional $1000 for either a new bearing or a restoration.

VI. PERFORMANCE EVALUATION

The self-aligning bearings on Bridge No. 5 were inspected on a yearly basis for the period 1984 through 1988 and were found to be performing satisfactorily. At the time of the final inspection, the bearings were accomodating approximately 5/8" of longitudinal movement at both ends of the structure. All anchor bolts were tight and secure and the alignment of the structure had not changed since the installation of the Uni-Ton bearings.

During the period from installation in October of 1982 to final evaluation in August of 1988, no maintenance or service was required.

Of the five companion structures with the low steel bearings, that had been built at the same time and undergone bearing repair in conjunction with Bridge No. 5, several were experiencing recurrent bearing distress. Bridge No. 6 (Rte. 100C over the Sprainbrook Parkway), had several loose anchor bolts, one of which had raised several inches. The bearing with the raised bolt appeared to be misaligned, but whether this was the cause or effect was unclear. Bridge No. 9 (Cross Westchester Expressway over White Plains Rd.), exhibited many bent bolts at the West abutment and substantial distress at the expansion bearings on the westernmost pier cap. Bridge No. 6 is a straight structure, while Bridge No. 9 is on a 2000 ft. radius. All bearings examined appeared to be well lubricated, although no maintenance or servicing had been performed since the fall of 1982.

VII. RECOMMENDATIONS

Based upon this evaluation, it is recommended that the center guided, self-aligning design be allowed as an alternative to conventional pot bearing designs, despite their higher cost.[1]

The reasons for this are as follows:

1. They are particularly well suited to curved structures in that the self-aligning feature reduces stresses resulting from difficult-to-predict thermal movements.

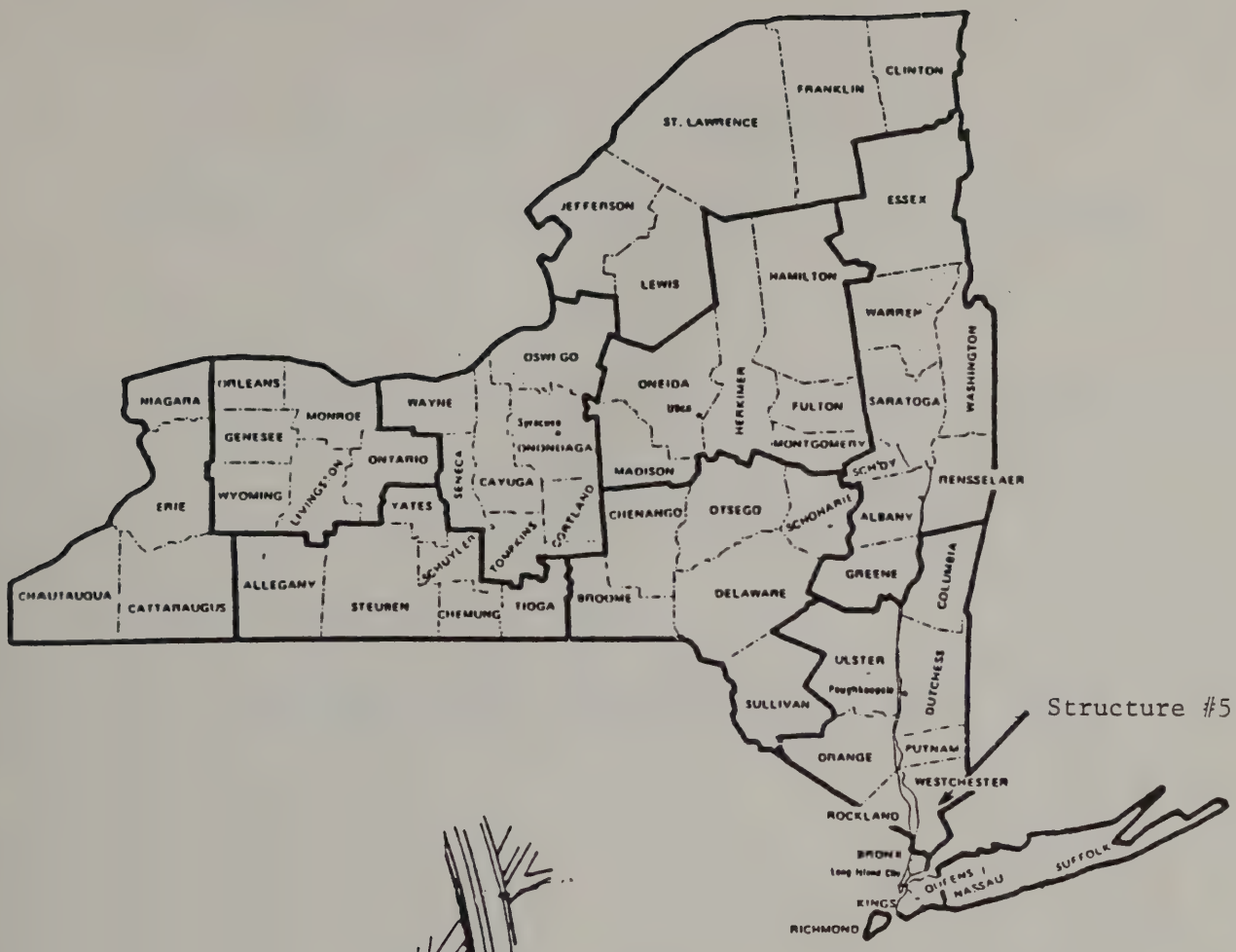
2. The additional cost is easily justified when use is restricted to curved structures.

3. It is virtually impossible to make a mistake in alignment.

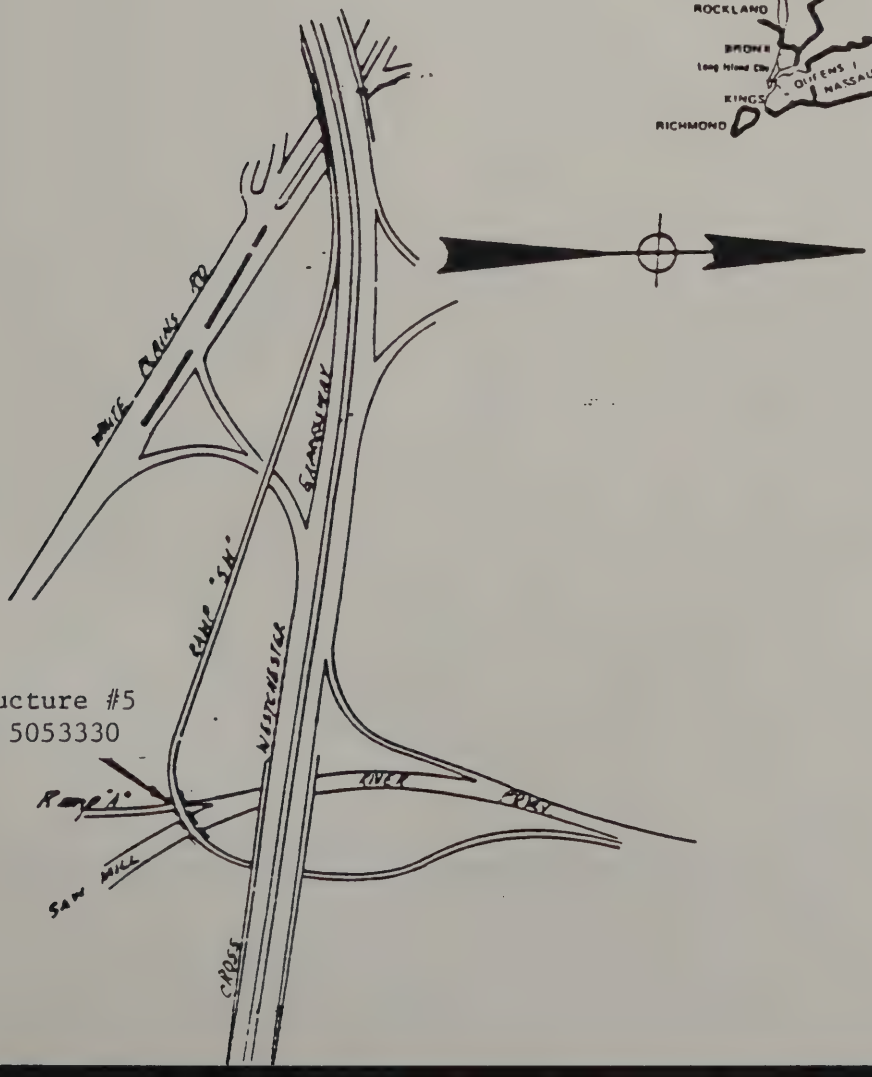
[1] The Uni-Ton bearing is no longer available from the Flurocarbon Company, however the center guided concept has been adopted by the bearing industry and is available from most manufacturers.

APPENDIX A

LOCATION MAPS



Structure #5



Structure #5
BIN 5053330

APPENDIX B

MANUFACTURER'S DATA - FLUOROCARBON UNI-TON BEARING SYSTEM

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FLUOROCARBON

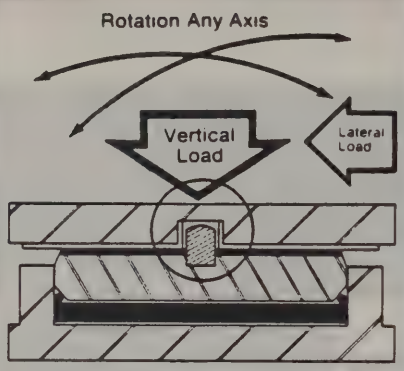
UNI-TON BEARING SYSTEM

The Fluorocarbon Company Offers 3 Basic UNI-TON® Bearing Systems

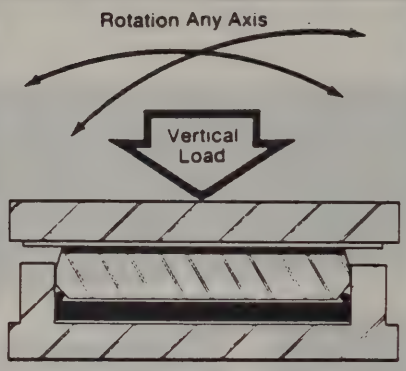
UNI-TON Bearing Systems are the answer wherever rotational movement, with or without lateral translation, must be accommodated.

These unique low friction slide bearings are at work today in countless structural and special projects: Bridges, rapid transit systems, pedestrian walkways, and highway overpasses. Petrochemical applications. High rise buildings, airports, and stadiums.

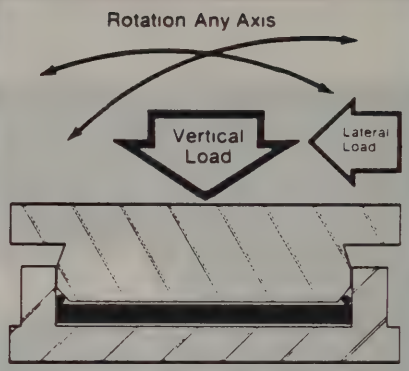
Economical, dependable, and maintenance-free. And as permanent as the structure they support.



The Laterally-Restricted UNI-TON System provides free rotation as well as horizontal movement on one center-line with a unique low-friction keyway system for guidance. Eliminates binding of restraint system under rotating conditions.



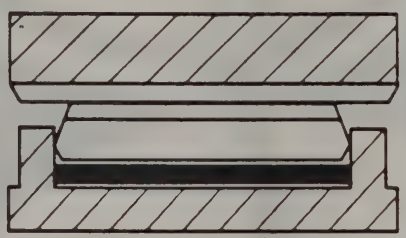
The Free-to-Move UNI-TON System provides free rotation as well as horizontal movement in any direction.



The Fixed UNI-TON System provides free rotation only.

UNI-TON® Design Highlights

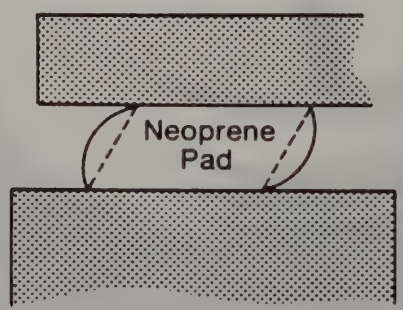
CONFINED



Confined Elastomer

Confined AASHTO neoprene exhibits hydrostatic principles and high load capabilities while maintaining a constant elevation. The translational shear exhibited in unconfined neoprene is eliminated insuring maximum working life.

UNCONFINED



Free Rotation

The incompressible neoprene, under high pressure, becomes "liquefied" and creates an effectively buoyant piston, free to rotate on any axis.

Advantages Of Using The New UNI-TON Bearing Systems

Fixed, Free-to-Move and "Keyway" Laterally Restricted

1. Standard use of a A-588 steel structurally stronger than A-36 and eliminates painting maintenance, although A-36 is available upon request.

2. All surfaces machined—no burnt or sharp edges to cut workers' hands, more aesthetically pleasing.

3. Cylinder and base plate machined from one piece of steel. This eliminates warpage due to welding, maintains a greater degree of dimensional accuracy, and is economically more feasible.

4. Stainless steel is standard 14 gauge #8 mirror finish for the smoothest possible interface.

5. The stainless steel is Heli-Arc stitch welded in place.

6. Identification tags are permanently attached to the bearings showing job reference number and bearing part number.

7. All center lines of bearings are permanently marked.

8. The UNI-TON keyway restraining system simplifies installation and shortens alignment time. To align the laterally restrained bearings the top plate is turned to the desired direction rather than turning the entire bearing assembly. On the first movement this system aligns itself to the desired direction of movement. (i.e., IF THE restraint—keyway is parallel to direction of movement.)

9. Fluorogold (15) is 15% glass reinforced structural grade Teflon® which meets all AASHTO specifications covering filled TFE.

10. The Fluorogold (15) is uniformly bonded in a press under controlled temperature and pressure settings. The heat cured epoxy is specially mixed and prepared to develop the strongest bond known in the industry.

11. The single ring sealing system within the cylinder has been subjected to extensive laboratory tests under design conditions, and satisfied our standards of performance.

12. UNI-TON bearings are designed to meet or exceed all AASHTO specifications for load (3500 PSI on Fluorogold) coefficient of friction (μ = .04) and masonry plates (less than 1000 PSI to concrete).

13. Fluorocarbon has the in-house facilities for testing UNI-TON bearings for both rotation and coefficient of friction. A maximum bearing size of 600 kips can be tested.

14. The key way lateral restraining system eliminates possible binding and seizing which may occur in conventional welded duel restraining bar systems under maximum design conditions.

15. The key is teflon-coated and the keyway is stainless steel lined so that the .03-.04 coefficient of friction is held in the lateral load condition.

To recap—some of our most important and valuable features for you are:

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a. Low friction keyway laterally restraining system speeds field setting of bearings, less time and lower cost needed for installation.

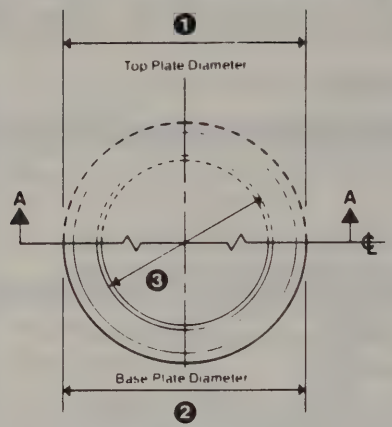
b. Base plate and cylinder machined from one piece of steel: this yields a higher quality and structurally stronger base assembly.

c. Fluorocarbon Co. has been in the reinforced teflon slide bearing business for twenty years. This means experience and integrity for you and your bearing needs.

The above facts and figures are only a few of the many reasons and ways Fluorocarbon UNI-TON Bearing Systems can help you with your "pot" bearing requirements.

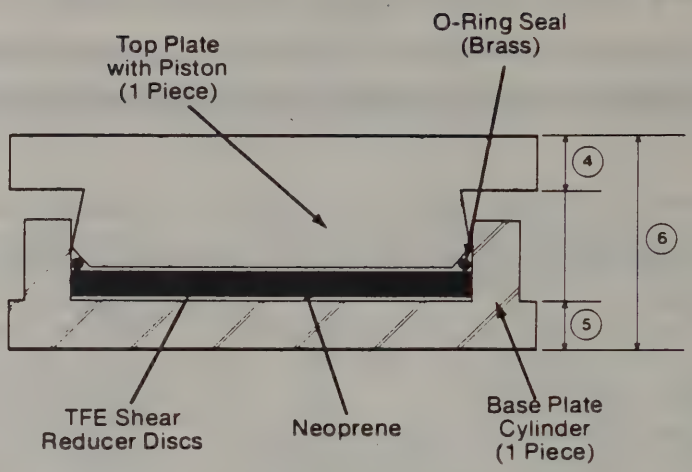
® Teflon is a registered trademark of the DuPont Corp.

Fixed **UNI-TON**



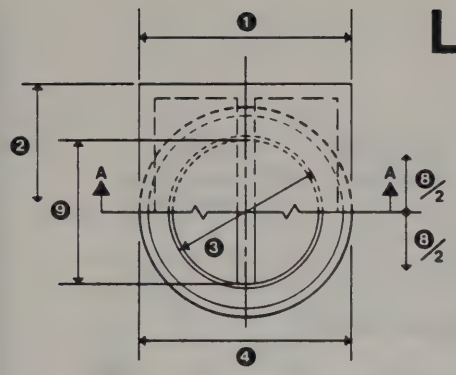
Cut-Away Plan

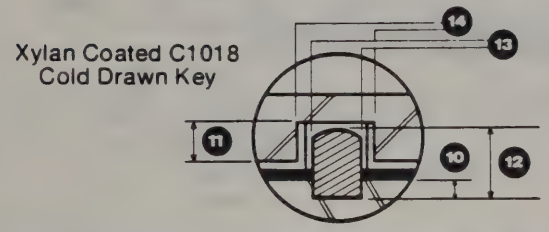
(Half of Top Plate Shown)

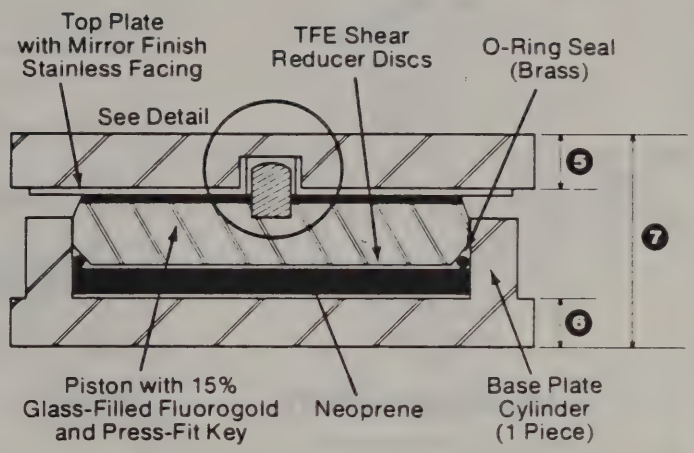


Bearing Type	Vert. Ld(K)	Lat. Ld(K)	Wt./Ea. (Lbs)	1	2	3	4	5	6
UBF-50	50.	5.	22.	6½"	6½"	5.15"	.75"	.75"	2 11/16"
UBF-75	75.	7.5	29.	7½"	7½"	6.08"	.75"	.75"	2¾"
UBF-100	100.	10.	39.	8½"	8½"	6.90"	.75"	.75"	2⅞"
UBF-125	125.	12.5	47.	9¼"	9¼"	7.62"	.75"	.75"	2 15/16"
UBF-150	150.	15.	57.	10⅛"	10⅛"	8.35"	.75"	.75"	2 15/16"
UBF-200	200.	20.	75.	11½"	11½"	9.50"	.75"	.75"	3⅛"
UBF-250	250.	25.	90.	12½"	12½"	10.51"	.75"	.75"	3⅛"
UBF-300	300.	30.	115.	13⅜"	13⅜"	11.43"	.76"	.85"	3⅜"
UBF-350	350.	35.	155.	14¾"	14¾"	12.25"	.82"	1.00"	3 13/16"
UBF-400	400.	40.	179.	15⅝"	15⅝"	13.09"	.87"	1.02"	3 15/16"
UBF-450	450.	45.	212.	16½"	16½"	13.82"	.92"	1.09"	4 3/16"
UBF-500	500.	50.	237.	17¼"	17¼"	14.51"	.96"	1.12"	4¼"
UBF-600	600.	60.	301.	18⅞"	18⅞"	15.98"	1.05"	1.20"	4½"
UBF-700	700.	70.	371.	20¼"	20¼"	17.17"	1.13"	1.29"	4⅞"
UBF-800	800.	80.	461.	21⅝"	21⅝"	18.30"	1.20"	1.41"	5¼"
UBF-900	900.	90.	544.	22⅞"	22⅞"	19.38"	1.27"	1.50"	5 9/16"
UBF-1000	1000.	100.	621.	24"	24"	20.36"	1.33"	1.57"	5 11/16"
UBF-1100	1100.	110.	741.	25⅜"	25⅜"	21.46"	1.41"	1.71"	6⅛"
UBF-1200	1200.	120.	823.	26⅜"	26⅜"	22.34"	1.47"	1.77"	6¼"
UBF-1300	1300.	130.	892.	27¼"	27¼"	23.21"	1.51"	1.77"	6⅜"
UBF-1400	1400.	140.	1032.	28⅜"	28⅜"	24.05"	1.58"	1.91"	6 13/16"
UBF-1500	1500.	150.	1119.	29¼"	29¼"	24.85"	1.63"	1.95"	6 15/16"
UBF-1600	1600.	160.	1213.	30⅛"	30⅛"	25.63"	1.67"	2.00"	7 1/16"
UBF-1700	1700.	170.	1333.	31⅛"	31⅛"	26.37"	1.73"	2.06"	7 5/16"
UBF-1800	1800.	180.	1425.	32"	32"	27.09"	1.78"	2.08"	7 7/16"
UBF-1900	1900.	190.	1565.	32⅞"	32⅞"	27.84"	1.83"	2.21"	7⅝"
UBF-2000	2000.	200.	1673.	33¾"	33¾"	28.51"	1.88"	2.24"	7¾"
UBF-2200	2200.	220.	1935.	35⅜"	35⅜"	30.00"	1.97"	2.37"	8 3/16"
UBF-2400	2400.	240.	2191.	36⅞"	36⅞"	31.29"	2.05"	2.48"	8 9/16"
UBF-2600	2600.	260.	2434.	38⅜"	38⅜"	32.51"	2.13"	2.56"	8¾"
UBF-2800	2800.	280.	2675.	39⅞"	39⅞"	33.68"	2.22"	2.60"	8 15/16"
UBF-3000	3000.	300.	2975.	41¼"	41¼"	34.81"	2.29"	2.72"	9 5/16"

Laterally-Restricted **UNI-TON**



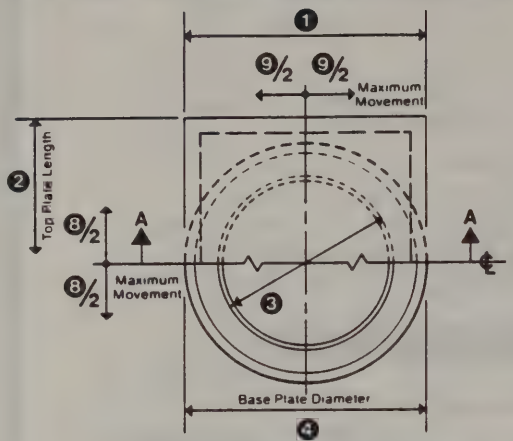




Bearing Type	Vert. Ld(K)	Lat. Ld(K)	Wt./Ea. (Lbs)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UBLR-50(2)	50	5.	28.	6½"	8¾"	5.13"	6½"	.75"	.75"	2 13/16"	2"	4 9/16"	.20"	.38"	⅜"	⅜"	.69"
UBLR-75(2)	75	7.5	37.	7½"	9⅜"	6.08"	7½"	.75"	.75"	2⅞"	2"	5½"	.20"	.38"	⅜"	⅜"	.69"
UBLR-100(2)	100	10.	49.	8½"	10½"	6.90"	8½"	.77"	.75"	3"	2"	6 5/16"	.20"	.38"	⅜"	⅜"	.69"
UBLR-125(2)	125	12.5	58.	9¼"	11⅛"	7.62"	9¼"	.78"	.75"	3 1/16"	2"	7"	.20"	.38"	⅜"	⅜"	.69"
UBLR-150(2)	150	15.	72.	10⅛"	11⅞"	8.35"	10⅛"	.88"	.75"	3 3/16"	2"	7⅝"	.27"	.44"	¾"	½"	.81"
UBLR-200(2)	200	20.	94.	11½"	13"	9.50"	11½"	.88"	.75"	3 5/16"	2"	8 13/16"	.27"	.44"	¾"	½"	.81"
UBLR-250(2)	250	25.	116.	12½"	14⅛"	10.51"	12½"	.96"	.75"	3 7/16"	2"	9 13/16"	.27"	.44"	¾"	½"	.81"
UBLR-300(2)	300	30.	148.	13⅜"	15"	11.43"	13⅜"	1.03"	.85"	3¾"	2"	10⅝"	.27"	.44"	¾"	½"	.81"
UBLR-350(2)	350	35.	195.	14¾"	15¾"	12.25"	14¾"	1.13"	1.00"	4¼"	2"	11 9/16"	.37"	.56"	1"	½"	.81"
UBLR-400(2)	400	40.	224.	15⅝"	16⅝"	13.09"	15⅝"	1.17"	1.02"	4 5/16"	2"	12 5/16"	.37"	.56"	1"	½"	.81"
UBLR-450(2)	450	45.	262.	16½"	17⅜"	13.82"	16½"	1.23"	1.09"	4⅜"	2"	13 1/16"	.37"	.56"	1"	½"	.81"
UBLR-500(2)	500	50.	294.	17¼"	18⅛"	14.51"	17¼"	1.28"	1.12"	4 11/16"	2"	13¾"	.37"	.56"	1"	½"	.81"
UBLR-600(2)	600	60.	383.	18⅞"	19½"	15.98"	18⅞"	1.50"	1.20"	5 1/16"	2"	15 3/16"	.45"	.75"	1¼"	¾"	1.06"
UBLR-700(2)	700	70.	456.	20¼"	20¾"	17.17"	20¼"	1.50"	1.29"	5 5/16"	2"	16⅜"	.45"	.75"	1¼"	¾"	1.06"
UBLR-800(2)	800	80.	557.	21⅝"	21⅞"	18.30"	21⅝"	1.57"	1.41"	5 11/16"	2"	17½"	.45"	.75"	1¼"	¾"	1.06"
UBLR-900(2)	900	90.	655.	22⅞"	23"	19.38"	22⅞"	1.65"	1.50"	6 1/16"	2"	18½"	.45"	.75"	1¼"	¾"	1.06"
UBLR-1000(2)	1000	100.	746.	24"	24"	20.36"	24"	1.73"	1.57"	6¼"	2"	19½"	.45"	.75"	1¼"	¾"	1.06"
UBLR-1100(2)	1100	110.	899.	25⅜"	25⅜"	21.46"	25⅜"	1.89"	1.71"	6 11/16"	2"	20½"	.55"	.94"	1½"	1"	1.31"
UBLR-1200(2)	1200	120.	1002.	26⅜"	26⅜"	22.34"	26⅜"	1.97"	1.77"	6⅞"	2"	21½"	.55"	.94"	1½"	1"	1.31"
UBLR-1300(2)	1300	130.	1088.	27¼"	27¼"	23.21"	27¼"	2.04"	1.77"	7"	2"	22 5/16"	.55"	.94"	1½"	1"	1.31"
UBLR-1400(2)	1400	140.	1255.	28⅜"	28⅜"	24.05"	28⅜"	2.13"	1.91"	7 1/16"	2"	23⅛"	.55"	.94"	1½"	1"	1.31"
UBLR-1500(2)	1500	150.	1363.	29¼"	29¼"	24.85"	29¼"	2.20"	1.95"	7⅛"	2"	23 15/16"	.55"	.94"	1½"	1"	1.31"
UBLR-1600(2)	1600	160.	1479.	30⅛"	30⅛"	25.63"	30⅛"	2.26"	2.00"	7¾"	2"	24⅜"	.68"	1.06"	1¾"	1"	1.31"
UBLR-1700(2)	1700	170.	1628.	31⅛"	31⅛"	26.37"	31⅛"	2.35"	2.06"	8 1/16"	2"	25 7/16"	.68"	1.06"	1¾"	1"	1.31"
UBLR-1800(2)	1800	180.	1747.	32"	32"	27.09"	32"	2.42"	2.08"	8 3/16"	2"	26 3/16"	.68"	1.06"	1¾"	1"	1.31"
UBLR-1900(2)	1900	190.	1945.	32⅞"	32⅞"	27.84"	32⅞"	2.59"	2.21"	8½"	2"	26⅞"	.68"	1.06"	1¾"	1"	1.31"
UBLR-2000(2)	2000	200.	2085.	33¾"	33¾"	28.51"	33¾"	2.66"	2.24"	8 11/16"	2"	27 9/16"	.68"	1.06"	1¾"	1"	1.31"
UBLR-2200(2)	2200	220.	2403.	35⅜"	35⅜"	30.00"	35⅜"	2.78"	2.37"	9⅛"	2"	29"	.82"	1.31"	2⅛"	1¼"	1.56"
UBLR-2400(2)	2400	240.	2720.	36⅞"	36⅞"	31.29"	36⅞"	2.90"	2.48"	9½"	2"	30¼"	.82"	1.31"	2⅛"	1¼"	1.56"
UBLR-2600(2)	2600	260.	3033.	38⅜"	38⅜"	32.51"	38⅜"	3.02"	2.56"	9¾"	2"	31½"	.82"	1.31"	2⅛"	1¼"	1.56"
UBLR-2800(2)	2800	280.	3349.	39⅞"	39⅞"	33.68"	39⅞"	3.15"	2.60"	10"	2"	32⅝"	.82"	1.31"	2⅛"	1¼"	1.56"
UBLR-3000(2)	3000	300.	3723.	41¼"	41¼"	34.81"	41¼"	3.27"	2.72"	10⅜"	2"	33¾"	.82"	1.31"	2⅛"	1¼"	1.56"

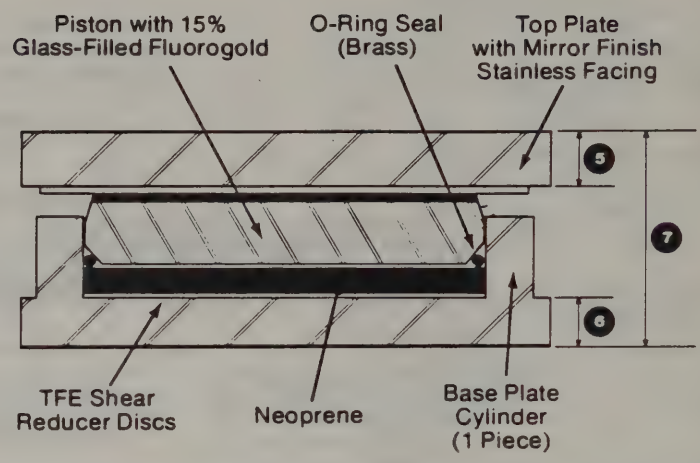
Indicates ⇧ Total Movement

Free-to-Move **UNI-TON**



Cut-Away Plan

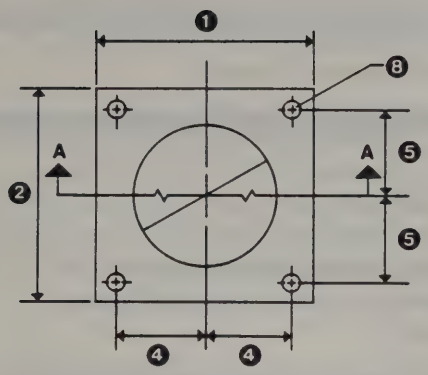
(Half of Top Plate Shown)

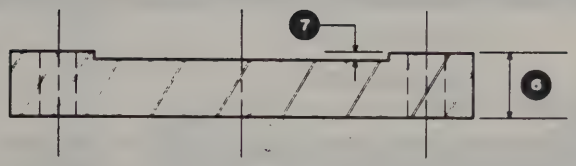


Bearing Type	Vert. Ld(K)	Lat. Ld(K)	Wt./Ea. (Lbs)	1	2	3	4	5	6	7	8	9
UBFTM-50(2)	50.	5.	28.	6½"	8¾"	5.13"	6½"	.75"	.75"	2 13/16"	2"	½"
UBFTM-75(2)	75.	7.5	37.	7½"	9⅝"	6.08"	7½"	.75"	.75"	2⅞"	2"	½"
UBFTM-100(2)	100.	10.	48.	8½"	10½"	6.90"	8½"	.75"	.75"	3"	2"	½"
UBFTM-125(2)	125.	12.5	57.	9¼"	11⅛"	7.62"	9¼"	.75"	.75"	3"	2"	½"
UBFTM-150(2)	150.	15.	68.	10⅛"	11⅞"	8.35"	10⅛"	.75"	.75"	3 1/16"	2"	¾"
UBFTM-200(2)	200.	20.	94.	11½"	13"	9.50"	11½"	.88"	.75"	3 5/16"	2"	1"
UBFTM-250(2)	250.	25.	116.	12½"	14⅛"	10.51"	12½"	.96"	.75"	3 7/16"	2"	1"
UBFTM-300(2)	300.	30.	148.	13⅜"	15"	11.43"	13⅜"	1.03"	.85"	3¾"	2"	1"
UBFTM-350(2)	350.	35.	193.	14¾"	15¾"	12.25"	14¾"	1.11"	1.00"	4¼"	2"	1"
UBFTM-400(2)	400.	40.	223.	15⅜"	16⅜"	13.09"	15⅜"	1.17"	1.02"	4 5/16"	2"	1"
UBFTM-450(2)	450.	45.	262.	16½"	17⅜"	13.82"	16½"	1.23"	1.09"	4⅝"	2"	1"
UBFTM-500(2)	500.	50.	294.	17¼"	18⅛"	14.51"	17¼"	1.28"	1.12"	4¾"	2"	1½"
UBFTM-600(2)	600.	60.	370.	18⅞"	19½"	15.98"	18⅞"	1.38"	1.20"	4 15/16"	2"	1½"
UBFTM-700(2)	700.	70.	433.	20¼"	20¾"	17.17"	20¼"	1.47"	1.29"	5 5/16"	2"	1½"
UBFTM-800(2)	800.	80.	557.	21⅜"	21⅞"	18.30"	21⅜"	1.57"	1.41"	5 11/16"	2"	1½"
UBFTM-900(2)	900.	90.	654.	22⅞"	23"	19.38"	22⅞"	1.65"	1.50"	6 1/16"	2"	2"
UBFTM-1000(2)	1000.	100.	746.	24"	24"	20.36"	24"	1.73"	1.57"	6¼"	2"	2"
UBFTM-1100(2)	1100.	110.	898.	25⅜"	25⅜"	21.46"	25⅜"	1.89"	1.71"	6¾"	2"	2"
UBFTM-1200(2)	1200.	120.	1001.	26⅜"	26⅜"	22.34"	26⅜"	1.97"	1.77"	6⅞"	2"	2"
UBFTM-1300(2)	1300.	130.	1087.	27¼"	27¼"	23.21"	27¼"	2.04"	1.77"	7"	2"	2"
UBFTM-1400(2)	1400.	140.	1254.	28⅜"	28⅜"	24.05"	28⅜"	2.13"	1.91"	7 7/16"	2"	2"
UBFTM-1500(2)	1500.	150.	1361.	29¼"	29¼"	24.85"	29¼"	2.20"	1.95"	7 5/16"	2"	2"
UBFTM-1600(2)	1600.	160.	1477.	30⅛"	30⅛"	25.63"	30⅛"	2.26"	2.00"	7¾"	2"	2"
UBFTM-1700(2)	1700.	170.	1626.	31⅛"	31⅛"	26.37"	31⅛"	2.35"	2.06"	8 1/16"	2"	2"
UBFTM-1800(2)	1800.	180.	1745.	32"	32"	27.09"	32"	2.42"	2.08"	8 3/16"	2"	2"
UBFTM-1900(2)	1900.	190.	1943.	32⅞"	32⅞"	27.84"	32⅞"	2.59"	2.21"	8½"	2"	2"
UBFTM-2000(2)	2000.	200.	2083.	33¾"	33¾"	28.51"	33¾"	2.66"	2.24"	8 11/16"	2"	2"
UBFTM-2200(2)	2200.	220.	2400.	35⅜"	35⅜"	30.00"	35⅜"	2.78"	2.37"	9⅛"	2"	2"
UBFTM-2400(2)	2400.	240.	2718.	36⅞"	36⅞"	31.29"	36⅞"	2.90"	2.48"	9½"	2"	2"
UBFTM-2600(2)	2600.	260.	3031.	38⅜"	38⅜"	32.51"	38⅜"	3.02"	2.56"	9¾"	2"	2"
UBFTM-2800(2)	2800.	280.	3546.	39⅞"	39⅞"	33.68"	39⅞"	3.15"	2.60"	10"	2"	2"
UBFTM-3000(2)	3000.	300.	3720.	41¼"	41¼"	34.81"	41¼"	3.27"	2.72"	10⅜"	2"	2"

Indicates ⇧ Total Movement

Masonry Plates





Cut-Away Plan

All Three Bearing Types	Wt./Ea. (Lbs)	1	2	3	4	5	6	7	8
UB( )-50	62.	14⅞"	14⅞"	6⅛"	4 7/16"	4 7/16"	1.02"	.19"	
UB( )-75	71.	15⅜"	15⅜"	7⅛"	4 13/16"	4 13/16"	1.06"	.19"	
UB( )-100	81.	16⅜"	16⅜"	8⅛"	5 3/16"	5 3/16"	1.10"	.19"	
UB( )-125	88.	16⅞"	16⅞"	9⅛"	5 7/16"	5 7/16"	1.13"	.19"	
UB( )-150	97.	17½"	17½"	10¼"	5¾"	5¾"	1.16"	.19"	
UB( )-200	110.	18⅜"	18⅜"	11⅛"	6 3/16"	6 3/16"	1.21"	.19"	
UB( )-250	123.	19⅛"	19⅛"	12⅛"	6 9/16"	6 9/16"	1.25"	.19"	
UB( )-300	137.	19⅞"	19⅞"	13¾"	6 15/16"	6 15/16"	1.29"	.19"	
UB( )-350	168.	20¾"	20¾"	14⅞"	7⅜"	7⅜"	1.46"	.19"	
UB( )-400	184.	21⅜"	21⅜"	15¾"	7 11/16"	7 11/16"	1.50"	.19"	
UB( )-450	200.	22"	22"	16⅛"	8"	8"	1.55"	.19"	
UB( )-500	214.	22½"	22½"	17⅜"	8¼"	8¼"	1.58"	.19"	
UB( )-600	275.	24½"	24½"	19"	9¼"	9¼"	1.71"	.19"	
UB( )-700	349.	26½"	26½"	20⅜"	10¼"	10¼"	1.84"	.19"	
UB( )-800	428.	28⅜"	28⅜"	21¾"	11 3/16"	11 3/16"	1.96"	.19"	
UB( )-900	512.	30⅛"	30⅛"	23"	12 1/16"	12 1/16"	2.08"	.19"	
UB( )-1000	593.	31⅛"	31⅛"	24⅛"	12 13/16"	12 13/16"	2.18"	.19"	
UB( )-1100	682.	33¼"	33¼"	25½"	13⅜"	13⅜"	2.27"	.19"	
UB( )-1200	782.	34¾"	34¾"	26½"	14⅜"	14⅜"	2.37"	.19"	
UB( )-1300	884.	36⅛"	36⅛"	27⅝"	15 1/16"	15 1/16"	2.48"	.19"	
UB( )-1400	983.	37½"	37½"	28½"	15¾"	15¾"	2.56"	.19"	
UB( )-1500	1089.	38¾"	38¾"	29⅝"	16⅜"	16⅜"	2.65"	.19"	
UB( )-1600	1214.	40⅛"	40⅛"	30¼"	17 1/16"	17 1/16"	2.75"	.20"	
UB( )-1700	1314.	41¼"	41¼"	31¼"	17⅝"	17⅝"	2.82"	.20"	
UB( )-1800	1439.	42½"	42½"	32⅛"	18¼"	18¼"	2.91"	.21"	
UB( )-1900	1556.	43⅝"	43⅝"	33"	18 13/16"	18 13/16"	2.99"	.22"	
UB( )-2000	1678.	44¾"	44¾"	33⅞"	19⅜"	19⅜"	3.06"	.22"	
UB( )-2200	1947.	47"	47"	35½"	20½"	20½"	3.22"	.23"	
UB( )-2400	2210.	49"	49"	37"	21½"	21½"	3.36"	.24"	
UB( )-2600	2495.	51"	51"	38½"	22½"	22½"	3.50"	.25"	
UB( )-2800	2794.	53"	53"	40"	23½"	23½"	3.63"	.26"	
UB( )-3000	3103.	54⅞"	54⅞"	41⅜"	24 7/16"	24 7/16"	3.76"	.27"	

HOLE SIZE DETERMINED BY OTHERS

Design Notes and Options

The tabulated data is based on the following assumptions, all of which may be varied within the limits given. A change in any assumption could affect the sizes tabulated. Our engineering department in Pine Brook can assist you if any change in the basic data is required.

Vertical Load:

The tabulated data covers the design load range in increments as follows: from 50 to 150 kips in 25 kip increments; from 150 to 500 kips in 50 kip increments and from 500 to 2000 kips in 100 kip increments and from 2000K to 3000K in 200K increments.

Lateral Load:

The lateral load design capacity is 10% of the vertical load as shown in the tabulated data. This load may be increased to 15% to meet specific design requirements. If higher lateral loads are required, alternate designs must be utilized.

Rotation:

The rotation capacity for the tabulated bearings is 86° (.015 Rad). Rotation up to 2 degrees ± 10% is acceptable.

Movement:

The movement for the tabulated Free-to-Move and Laterally-Restricted UNI-TON is ±1" (one inch). Greater movements can be accommodated with corresponding increases in top plate length and/or width and thickness.

Weight:

The weight tabulated is the weight of the UNI-TON bearing itself, exclusive of any studs or masonry plates.

Top & Base Plate Sizes:

The sizes tabulated are based on welded or studded attachment. Bolted attachment will require additional engineering. Consult Pine Brook Engineering Dept.

Masonry Plates:

The sizes indicated will reduce the pressure from the bottom bearing plate of the bearings to 1000 psi. UNI-TON bearings are designed with a maximum reactive pressure out the top or base of 2250 psi. All the masonry plates indicated are assumed to be A588 steel. See typical installation suggestions, page 8.

So why called "MASONRY" plates?

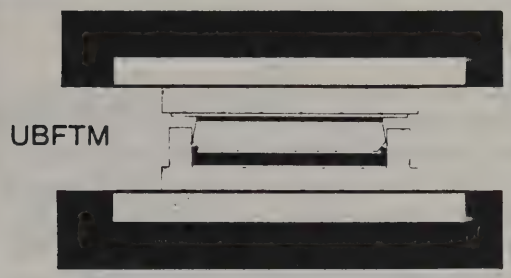
Installation:

For suggested details see page 8. The bearing top or base plate must be grouted or shimmed so that the entire area is supported. Localized bending is not acceptable. The bearing seat or bearing itself shall be levelled with transit sightings to at least (3) corners. The accuracy of levelness is extremely important. If the top plate and base plate are not parallel, the angle between them is, in effect, reducing the allowable rotational capability of the bearing.

Installation Details

Concrete to Concrete

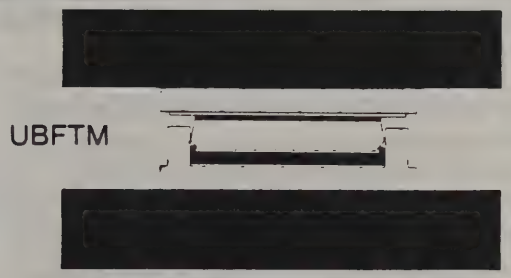
For concrete to concrete applications a reducer plate is required. This plate reduces the load to 1 KSI or less. The masonry plate can be supplied with a variety of attaching means.



Masonry Plates (Using studs and or anchor bolts)

Steel to Steel

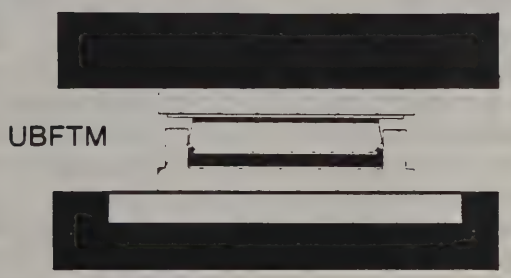
For steel to steel applications, reducer plates are not required and bearings can be welded directly to steel members.



Upper plate of bearing welded to beam

Steel to Concrete

For steel to concrete applications, a reducer plate is required at the bottom of the bearing to reduce the load to 1 KSI or less. The top plate can be welded directly to the steel member.



Masonry Plates (With studs anchor bolts or shear keys)

Bearing Test Capabilities

Tests to determine coefficient of friction, establish wear data, cold flow characteristics, and bearing performance can be conducted at vertical loads up to 600K kips, slide travel to 6″, slide speeds up to 1 ft. per minute. Interface and bearing temperatures from ambient to 250°F. are available. Horizontal forces to 110 kips can be generated.

Friction tests submerged in liquids up to a vertical load of 90 kips can be conducted.

Vertical pressure and compression tests up to 600K kips can be run.

Special applications up to 2° can be achieved.

Specimen conditioning and thermal cycle tests can be conducted in a temperature range from −100° to 300°F.

Temperatures can be monitored at 7 points simultaneously during any test.

Standard UNI-TON Bearing Specifications

General:

Furnish and install UNI-TON bearings (or an approved equal [See Section F]) as complete factory-produced assemblies manufactured by The Fluorocarbon Company, 337 Change Bridge Rd., Pine Brook, N.J. 07058. These bearings shall be either fixed rotational units or be expansion rotational units having sliding surfaces of Fluorogold (15) against stainless steel. They shall provide for rotation in all directions and for sliding in directions as indicated on the contract plans. The bearings shall include all directly connected or welded anchorage hardware. All bearings shall be supplied from the one supplier above. Any changes in plan size and/or height due to an "or equal" design, shall be submitted to the Bureau of Bridge Design within 30 days after the contract has been awarded.

Materials:

1. In the expansion bearings, the polytetrafluoroethylene (TFE) sheet used as a mating surface for the stainless sheet shall be Fluorogold (15). 15% glass-fibre filled TFE sheet, resulting from skiving billets formed under hydraulic pressure and heat. The resin shall conform to the latest requirements of ASTM D 1457.
2. Stainless steel mating surfaces shall be 14 ga. (min.) ASTM A240 type 304 sheets with a maximum surface roughness of 20 Rms.
3. Structural steel for all major bearing components shall be carbon steel conforming to ASTM A588 unless noted otherwise on the contract drawings.
4. Neoprene shall conform to AASHTO durometer 50. A 1/64" thick unfilled polytetrafluoroethylene shim shall be placed on either side of the Neoprene inside the bearing.
5. Protective finish shall be as specified on the contract drawings.
6. Anchor studs, if required, shall be Nelson type H4 or an approved equal.
7. Epoxy adhesives, when used, must be compatible with the materials to be bonded together and must also be suitable for the environmental conditions. Epoxy adhesive shall be tested by the manufacturers so that strength requirements are insured.

Design:

Expansion as well as fixed rotational bearings shall be designed for a minimum total rotation of 0.015 radians. This is accomplished by the proper thickness Neoprene.

The rotation shall be considered the sum of live load rotation, changes in camber during construction, and misalignment of the bearing seats due to construction tolerances. The design shall include compensating provision for grade, if required, e.g., beveled sole plates.

The TFE sliding surface shall have the following thickness:

1. Fluorogold (15)—3/64".
   The coefficient of friction used for design shall be as follows:

Aver. Pressure on TFE	Design Coefficient
3500 psi	.04

Fabrication:

The bearings shall be manufactured with all attachment features, to the dimensions, as detailed on the contract plans. The TFE sliding surface must be bonded to the piston under factory controlled conditions using heat and pressure for the time required to set the epoxy adhesive used. It shall be free from bubbles and burnished to an absolutely smooth finish.

The stainless steel mating surface for the expansion bearings shall be heliarc stitch-welded around its perimeter to the back-up plate.

Each bearing shall be assembled at the plant, shall be marked for permanent identification and traceability utilizing weather-resistant tags. They shall be delivered to the site of construction as a complete unit. The bearings shall be held together with removable restraints so that the sliding surfaces are not damaged. They shall have centerlines marked on both top and base plates for alignment in the field. The bearings shall be shipped in moisture-proof and dust-proof covers.

The base/cylinder of all pot bearings shall be fabricated from one piece. All internal and external bearing surfaces are to be fully machined to insure maximum bearing performance as well as aesthetic requirements.

All laterally-restrained bearings shall have self-aligning capabilities for ease of field installation as well as to prevent possible binding of the restraint system, thereby, eliminating possible failures.

The sliding area of the restraint system shall be teflon-coated on one surface sliding against a stainless mating surface during times of lateral reactions to maintain low frictional development at all times.

Installation:

The bearings shall be placed between dry, clean abutting surfaces, which shall be free from all dirt, oil, grease or other foreign substances. The bearings shall be placed in accordance with the recommendations of the manufacturer, contract drawings and as directed by the Engineer.
Welding, as a means of attachment, shall be done in a controlled manner using multiple passes or stitch welding techniques to control the heat build-up which might adversely affect the bearing.

Shop Drawings, Mill Certificates, Test Reports, "Or Equal" Designs and U.S. Manufacture:

The Contractor shall furnish shop drawings detailing the structural features of each bearing to be approved by the Engineer prior to fabrication.

The Contractor shall furnish material certificates of the steel, TFE and Neoprene.

A representative sample bearing of at least 100 kip capacity and less than 400 kip capacity shall be tested and a documented report furnished giving proof load and friction results by the bearing manufacturer.

Alternate, "or equal," designs will be entertained by the Engineer only if received at least 10 days in advance of the award of contract. They must be fully documented submittals as to quality, substance, and function. Approval of this "or equal" design will be issued to all prospective contractors bidding the job by addendum to the contract indicating that this manufacturer has an acceptable "or equal" product. If the contract has been awarded, the Engineer cannot review or consider any other product on an "or equal" basis at this point in time. However, if a reduction in the contract price can be obtained for the Owner, or the inability of a specified manufacturer to meet a delivery schedule arises, the Engineer may, at his descretion, review a new design or an "or equal" bearing.

The production facility shall be located within the continental limits of the United States.

Standard UNI-TON Bearing Specifications